Sugar Beet Yields From Varying Row Spacings and Acre Populations

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PRELIMINARY TESTS conducted at Rocky Ford, Colorado, in 1945, on 20-inch and 30-inch width beet rows, with equal acre populations, gave yield results significantly in favor of the narrower row. Since beet plantings in rows wider than 30 inches are not likely to be generally made, an experiment was set up in 1946 to determine what yield differences would be obtained from plantings of 20-, 24- and 28-inch row widths; and at acre beet-population levels of 22,000, 26,000, and 30,000. This paper reports the results obtained from this experiment for the 2-year period 1946-47.

Experimental Procedure

The 3-row spacings at three population levels, providing nine variables, were set up as a randomized-block experiment, and 6 replications of plots of each variable were planted in each of the 2 years. Plots were 6 rows wide by 40 feet long. American No. 3 segmented beet seed, germinating above 85 percent, was used both years. The seed was planted at a rate of 5.2 pounds per acre in 1946, and in 1947 at 6.0 pounds per acre. At thinning time, a long measuring stick, with the beet spacing distance for each plot indicated on the stick by use of thumb-tacks, was used to obtain the correct spacing distance between beets in the row. Long hoes were used for blocking and short-handle, narrow hoes for thinning. After thinning, stand counts were obtained. At harvest all marketable beets from 36 feet of row, from each of the two center rows of each plot, were taken for yield data. Only beets weighing more than .33 pound were considered marketable. Sucrose percentage data were obtained from the analysis of 2 samples of 15 marketable beets each, from each plot.

Since the tests conducted each year were identical in plot lay-out, and planted on fields less than 1 mile apart, the data obtained are reported as a 12-replicate test for the 2-year period.

Experimental Results

Table 1 gives the acre populations planned for, those obtained, and the distribution pattern of the beets.

The beet stand obtained in both years was not quite adequate to permit populations of 30,000 beets per acre in the 24- and 28-inch rows. In 1946, shallow planting along with dry top soil, resulted in low and erratic stands, and in 1947 severe crusting of surface soil occurred which reduced the emerging stand of beets. Some loss of beets occurred after

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thinning due to root diseases; and these losses, along with beets smaller than marketable size further reduced stands, as shown by the marketable beets harvested. The greatest average loss between thinning date and harvest occurred in the widest row spacing.

Table 1. Beet spacing pattern, along with acre populations planned for, and obtained. Average 1946-47.

Treatment No.	Acre population wanted	Distribution pattern in inches	Thinned acre population obtained	Marketable beets	
				Total per acre	Percent of thinned stand
1	21,994	20x14.26	21,334	20,634	96.9
2	22,022	24x11.88	22,052	21,015	95.3
3	22,009	28x10.18	21,496	20,341	94.6
4	26,006	20x12.06	25,720	24,748	96.2
5	26,006	24x10.05	25,096	23,346	93.0
6	25,984	28x 8.62	24,469	23,045	94.2
7	30,013	20x10.45	29,279	28,467	97.2
8	30,013	24x 8.71	27,593	25,542	92.6
9	29,983	28x 7.41	25,130	22,743	90.5

The yield results obtained in the experimental test are given in table 2.

Table 2. Yield of beets in tons and sugar in pounds per acre with sucrose percentage, from beets planted in 3-row spacings at three different population levels. Average 1946-47.

Treatment No.	Distribution pattern of beets to allow an acre population of:	Row spacing	Tons beets per acre	Sucrose percent	Gross pounds sugar per acre
1	22,000 (low)	20	18.62	14.06	5226
2		24	17.88	14.00	5011
3		28	16.97	14.21	4830
4	26,000 (medium)	20	18.66	14.30	5322
5		24	17.39	14.24	4950
6		28	17.27	14.30	4941
7	30,000 (high)	20	18.66	14.58	5451
8		24	17.46	14.26	4974
9		28	16.47	14.44	4749
General mean			17.70	14.27	5050
Significant differences (odds 19:1)			1.54	.74	501

The yield of beets per acre was higher from 20-inch rows than from either the 24- or 28-inch rows at each of the three levels of population, and significantly higher than the 28-inch rows in the "low" and "high" acre populations. The average beet yield of the 20-inch row spacing, considering all three populations (treatments 1, 4, 7) as compared with similar averages for the 24-inch and 28-inch spacings, shows a significant increase in yield in favor of the narrow row spacing.

Sucrose percentage differences in this test did not quite reach the 5 percent level of significance; nevertheless there is a definite trend in favor of higher sucrose in the higher acre populations.

In sugar per acre, the highest yield was obtained from the high acre population (28,467 beets) planted in 20-inch rows. This figure is significantly higher than the sugar yields from 28-inch rows at all three population levels, as well as 24-inch rows at the medium population level.

Discussion

The results of this experiment indicate that the distribution pattern affected the yield of beets. Yields per acre of beets and of sugar were highest for rows spaced 20 inches apart at each of the three acre-population levels. In sucrose percentage, no significant differences were found, but a trend toward higher sucrose from higher acre populations, regardless of row width, was observed. These results are in general agreement with the earlier investigations of Skuderna, et. al. (3),[2] and Brewbaker and Deming (1), and with more recent reports of Tolman (4), and Doxtator and Skuderna (2).

One of the main difficulties encountered in this experiment was that of obtaining high acre-beet populations from row spacings wider than 20 inches (table 1). Where 30,000 beets per acre were required, the thinned stand obtained from 24-inch rows and 28-inch rows was less than from 20-inch rows by 1,686 and 4,149 beets, respectively. This lack of stand is explained by the inadequate and non-uniform emergence of the beet plants. Further, the loss of harvested beets was greater in the 24- and 28-inch rows than in the 20-inch rows because of a higher percentage of beets smaller than marketable size.

Considering that earlier investigations of acre beet populations have shown that 25,000 to 35,000 beet plants per acre are more generally productive of high sugar yields than lesser populations, it would appear most advantageous to maintain relatively high populations per acre regardless of the width of the beet row. However, to obtain the acre population which gave the highest yield in this experiment it would be necessary, in 28-inch rows, to space the beets less than 8 inches apart. This is a much more difficult task for hand labor or for mechanical thinning machines than to space beets 10.5 inches in 20-inch row plantings to obtain the same acre population.

Wider row spacings do have the advantages of reducing mileage travel of drills, cultivators, and other row machines, and of more easily accommodating the large and heavy beet harvesters of the present day. However, the data from this experiment indicate that in this area the obtaining of adequate beet stands was increasingly difficult in wide rows; and with less than adequate acre populations sugar-per-acre yields were significantly lowered. Even at the low and medium acre-population levels where similar numbers of beets were obtained for all three spacings, there was a consistent trend toward low beet tonnage and sugar-per-acre yields with wider row spacings.

Summary

Replicated plot tests in 1946 and 1947 near Rocky Ford, Colorado, of 20-inch, 24-inch, and 28-inch row spacings, at each of three acre-population levels, resulted in a definite trend toward lower yields of sugar per

[2]The numbers in parentheses refer to literature cited.

acre with increased widening of beet rows. Significantly lower sugar-per-acre yields were obtained from the 28-inch row width at all three acre-population levels, and a significantly lower sugar-per-acre yield from the 24-inch row spacing at the medium acre-population level, than from the 20-inch row spacing at the high acre-population level.

Sucrose percentage in marketable beets was higher from the higher acre-beet populations, but did not quite reach the significant level. Width of row did not affect sucrose percentage appreciably in this experiment.

Difficulty was experienced in obtaining a stand of 30,000 beets per acre, in spite of adequate planting rates of seed high in germination, and with careful thinning methods. This difficulty was greatest in the 28-inch row spacing.

Literature Cited

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